MULTI-ROUND DIVISIBLE REAL-TIME SCHEDULING ALGORITHM ON MULTIPROCESSOR PLATFORMS

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To my beloved mother and father

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In the name of Allah The Most Gracious The Most Merciful, Praise is to Allah who created us and gave us intelligence and guidance and peace is upon our prophet the teacher of all mankind and peace is upon his family.

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ABSTRACT

Recent real-time systems and applications are becoming more complex and contain more functionality. Therefore, these systems are increasingly to be implemented upon multiprocessor platforms, as they require complex sharing of data, synchronization and parallelism. To overcome this limitation, recent researches have applied Divisible Load Theory (DLT) to real-time multiprocessor scheduling and the theory is known as Real-time Divisible Load Theory (RT-DLT). However, most current studies in this field are about distributing data in single-round algorithm and there are limited studies in multi-round strategy in real-time systems to reduce idle time. Moreover, current multi-round studies have some performance problems mainly due to inefficient use of available resources and long execution time for task scheduling. This research is carried out to address the problem of task execution on real-time multiprocessor platforms to reduce inserted idle time in order to meet task deadline. Therefore to achieve that, this research developed three significant multi-round algorithms which are: MultiMINPROCS, OPTROUND and MINCOMPTIME in expanding the current single-round RT-DLT to multi-round RT-DLT. Series of experimental evaluations showed that the three developed algorithms had improved the performance of previous both single-round and multi-round algorithms. The first algorithm computed the minimum number of processors needed to complete the job by its deadline, 40% improved the previous single-round algorithm and 33% improved previous multi-round algorithm. The second algorithm determined the most efficient number of round. Finally the third algorithm computed the minimum completion time in order to meet the task's deadline, 35% improved the previous single-round algorithm and 38% improved previous multi-round algorithm.

ABSTRAK

Sistem masa nyata dan aplikasi terkini menjadi semakin kompleks dan mengandungi lebih banyak fungsi. Justeru itu, sistem ini semakin kerap dilaksanakan dalam platform pelbagai pemproses, disebabkan oleh keperluan dalam perkongsian data, penyelarasan dan keselarian yang kompleks. Bagi mengatasi kekurangan ini, kajian sebelum ini telah menggunakan Teori Pembahagian Beban (DLT) bersama penjadualan multipemproses masa nyata dan teori ini dikenali sebagai Teori Pembahagian Beban Masa Nyata (RT-DLT). Walau bagaimanapun, kebanyakan kajian semasa dalam bidang ini adalah merangkumi data dalam algoritma pusingan tunggal dan terhad kepada kajian dalam strategi multi-pusingan sistem masa nyata untuk mengurangkan masa melahu. Selain itu, kajian semasa pusingan pelbagai ini mempunyai masalah prestasi disebabkan oleh penggunaan sumber sedia ada yang tidak efisien dan mempunyai masa pelaksanaan yang lama dalam penjadualan tugas. Kajian ini dijalankan untuk menangani masalah pelaksanaan tugas pada platform masa nyata multipemproses untuk mengurangkan kemasukan masa melahu bagi memenuhi tempoh had tugas. Oleh itu, bagi mencapai matlamat kajian ini tiga algoritma penting multi-pusingan iaitu MultiMINPROCS, OPTROUND dan MINCOMPTIME telah dibangunkan bagi menambah balik algorithma pusingan tunggal RT-DLT kepada multi-pusingan RT-DLT. Pengujian eksperimen secara bersiri menunjukkan pembangunan algoritma bertambah baik bagi pusingan tunggal dan multi-pusingan algoritma sebelumnya. Algoritma pertama mengambil kira bilangan minimum pemproses yang diperlukan untuk menyelesaikan tugas sebelum tempoh had adalah 40% lebih baik daripada algoritma pusingan tunggal dan 33% lebih baik daripada algoritma multi-pusingan kajian sebelumnya. Algoritma kedua menentukan bilangan pusingan paling cekap. Algoritma ketiga pula mengira masa minimum tempoh had diselesaikan, dengan 35% lebih baik daripada algoritma pusingan tunggal dan 38% lebih baik daripada algoritma multi-pusingan kajian sebelumnya.